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MOSAIC DISEASE OF SUGARCANE

R. D. Anstead.
IMPERIAL BUREAU OF MYCOLOGY

MADRAS
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MOSAIC DISEASE

BY

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(*Reprinted from the "Madras Mail."*)

The disease of sugarcane known as "mosaic," because it produces a mottled appearance of the leaves, is somewhat of a mystery and its exact cause has hitherto defeated the scientists who have studied it. It is known to be parasitic, but no specific organism associated with it has been isolated. It is generally believed to be due to an extremely minute organism too small to be seen by the most powerful microscope, so small that it can pass through the finest filter. Such organisms are known as "filterable viruses" and quite a number of them are known to attack both plants and animals. Cancer and distemper of dogs, foot and mouth disease of cattle, are all caused by such minute organisms and a number of plants are attacked by "mosaics," peach, and cane; tobacco and cucumber; potato, lettuce, spinach, maize, and sugar beet; aster and dahlia. Each year the list lengthens among our food plants and flowers. The infectious nature of these diseases is strong evidence of the presence of a living organism, but just exactly what that organism is no one quite knows.

A Widespread Disease.

Mosaic is the most widespread of all the many diseases of sugarcane, and in many places it is considered to be the worst. It destroys the chlorophyll cells of the leaves and thus interferes with growth and metabolism, resulting in stunting of the plant and consequent reduction in the yield of sugar. In the Philipines it has been known to actually kill plants. In Cuba and elsewhere, where the disease is very bad, the yield of sugar is said to have been reduced by it to the extent of over 70 per cent. There is evidence to show that in India "mosaic" of several years standing has produced severe stunting of canes. The disease has been found in almost all sugar growing countries, and it has no doubt been introduced from country to country by means of infected setts.

In the Madras Presidency the disease is quite common, but luckily it is not so bad as in other countries. Knowing the capabilities of the disease for evil, however, it is wise to take precautions to check its spread as much as possible before it gets any worse. There is also another danger. The disease attacks a large number of grasses, some of which are valuable grains and fodders. Among these are maize

and millet. If the disease spread to those it might cause a very serious loss. Herein lies the real importance of this disease. Professor Lewsis R. Jones speaking recently at the inauguration of the Boyce Thompson Institute of Plant Pathology in America said: "The especially portentous thing is that this type of disease is subtly infectious, like the comparative 'virus' disease of animals such as foot and mouth disease and rabies. No microscope has revealed a casual 'germ', but whatever the nature of the 'virus' is it is readily carried by sap-sucking insects from diseased to healthy plants."

"Even more startling is the frequency with which the 'virus' has proved inoculable from one type of plant to another. Thus it may be transmitted from cultivated plant to weed and, after overwintering in the fence row perennial, again return next season to ruin the adjacent field crop. For some years the increasing loss with potatoes and other food plants from these virus maladies has convinced pathologists of their seriousness. This was, however, recently brought home in a most striking way to commercial interests when the sugarcane fields were invaded by it, first in Hawaii and the Orient, then in Louisiana, now in Cuba. The possible significance in cost of living resulting from a worldwide crippling of the sugar industry is startling. Were we in the United States of America not sufficiently alarmed by such a suggestion we may add the further possibility that this cane 'virus' may be transferred to maize. What more alarming tax could be imposed on American food products than the affliction of our basic crop, maize, with a serious toll-taking disease?"

A similar danger lies before us in India because it is possible that the "virus" might spread from cane to the cholam crops, and if it did so this might prove most disastrous. It is for this reason, more perhaps than on account of the loss caused to sugarcane, that the Mycologists are anxious to induce people to take steps to control this disease while it is still in its initial stage and there is some chance of keeping it within bounds.

Unfortunately perhaps mosaic is a disease which does not show up very clearly, it is what may be called an "unconvincing" disease, in contrast to one which produces a big dead spot on the leaves for instance, or causes them to wither and dry up. The pattern it produces on the leaf differs with different varieties of cane and in none is it very marked. It produces merely a series of white streaks and blotches which on the whole gives the leaf a mottled appearance. On the stem, especially on the upper portion, longitudinal streaks and cankered areas appear.

Insects are a common factor in the dissemination of infectious diseases. It is common knowledge how flies carry diseases like dysentery and mosquitoes transmit malaria. In the case of mosaic aphids are suspected as agents of transmission of this disease from cane to cane. The most usual way, however, in which the disease is spread is by the planting of infected material. It is known that the disease is not transmitted through the soil. If diseased patches are

replanted with setts obtained from healthy plants they do not contract the disease, showing that the causative agent is not in the soil. Setts obtained from infected plants invariably produce diseased stools. Some varieties of cane get the disease more readily than others, and some appear to be practically immune to it. This indicates a promising way of frustrating the disease, and the plant breeders have come to the rescue by selecting and actually evolving resistant varieties. In Hawaii by a systematic selection of healthy seed canes and the persistent use of resistant varieties the losses from mosaic have been greatly reduced. In Madras, the Agricultural Department are investigating the different degrees of susceptibility of the different varieties of cane in use in the Presidency with the object of finding out those which show signs of resistance and breeding still more resistant varieties from them.

Control Methods.

No cure for this disease is known and in the meanwhile control measures should be adopted. The simplest of these is to take care to plant setts free from infection. It is a well-established fact that the disease is transmitted by cuttings, and if setts of diseased canes are planted year after year the disease gets more and more virulent. So setts for planting should be most carefully selected from stools free from the disease, and such varieties as are known to be resistant should be grown. The fields should then be carefully watched and as soon as mosaic appears the stools attacked should be dug out and burned. This is known as "rogueing". The method is of course only feasible if the infection is small and the number of stools to be removed small. If the infection is very high little can be done, the canes should be milled at harvest time, all the trash should be burned, the field should be deeply ploughed, and all portions of old canes remaining collected and burned. New setts should be obtained from an uninfected source for the next planting. Diseased fields should never be ratooned because ratooning perpetuates the disease and the fields become a source of infection to the surrounding canes. Clean cultivation is also essential. Many weeds especially grass are subject to attack by mosaic and are also food plants for the aphids which aid in its dissemination, and so these should be carefully destroyed. Incidentally, this is good farming practice even were the disease not present. Attempts have been made to control or mitigate the disease by the use of different fertilizers but with no success. Dr. Stevenson of the Department of Agriculture, Porto Rico, where the mosaic is very virulent, says "while experiments show clearly the value of fertilizers often resulting in as high as fifty per cent gain in yields there never has been the slightest evidence that there was any effort in controlling or even checking mosaic". Control measures depend for their success upon the interest and co-operation of all concerned. They must be thorough and widespread to minimize the risk of infection from neighbouring fields. As with most diseases it is not a bit of use for one or two people only to take precautions or to adopt

control measures, their fields are immediately reinfected by their more careless neighbours. Co-operation is essential and this means education and general knowledge of the importance of control measures and the need for them, and it is the object of this article to try and explain this.

MAP OF THE MADRAS PRESIDENCY

Distribution of Mosaic Disease on Sugarcane.

MOSAIC DISEASE OF SUGARCANE IN SOUTH INDIA

BY

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Mosaic disease has long been known in several countries, but was reported from several provinces in India only recently. It was, however, not recorded in the Southern Presidency until July 1925, when a crop of cane raised on the Central Farm wet lands, Coimbatore, was found to be affected.

The heavy infestation of mosaic in the Central Farm canes, which are in close proximity to the Imperial Cane Breeding station, made it imperative that the disease should be investigated in entirety and kept out altogether, at least from the neighbourhood, so that the infection may not spread through the cane breeding station to several large cane-growing tracts in Upper India which it serves as a breeding and seed distribution centre.

A survey made of the sugarcane areas in this Presidency showed that the disease is not general nor confined to well-defined areas in any locality. In several taluks no disease could be seen, while in others which are separated from each other by long distances, the disease was visible.

Investigations were taken up vigorously and an account of the progress made between the years 1925 to 1928 is recorded here. The methods adopted were, (*a*) survey of the disease in the sugarcane districts in the Presidency, (*b*) examination of the Imperial Cane Breeding station and the sub-station attached thereto, (*c*) study of the symptoms and effects of the disease, (*d*) modes of infection and agencies in its spread, (*e*) determination of relative resistance among cane varieties, and (*f*) control methods.

Survey.

A survey was made in important cane tracts in almost all cane-growing districts (vide map).

Circars.—In the Circars the disease was found in Gōdāvari and Kistna and was absent in other districts. In Gōdāvari, the disease was severe in Cocanada, Ramachandrapur, and Peddapur, three contiguous taluks, while in Razóle and Amalapur it was very slight. Disease was as bad in the heavy clays of Ramachandrapur as in the light soils along the Yeleru drain of Cocanada Taluk.

Carnatic.—In the Carnatic, there was little disease in Nellore and Chingleput, while in South Arcot, it was severe, Cuddalore Taluk showing the worst infection.

Central districts.—Here the infection was moderate and the disease was noticed in Chittoor and Chandragiri (Chittoor District), Kalahasti and Gudiyattam (North Arcot District), Dharmapuri of Salem District, and in Avanashi of Coimbatore District.

West Coast.—On the West Coast, Upidi and Kāsargōd, where canes are largely grown, were free, while Taliparamba and Pattambi in Malabar were found slightly affected.

In Gōdāvari, percentage of infection varied from 3 to 30 per cent, 10 per cent being the average. In the Carnatic, it averaged about two, though a few badly affected areas showed as high as 50 per cent infection. In the central districts and in Taliparamba on the West Coast, the disease was very slight, while at Pattambi it rose as high as 50 per cent.

Red Mauritius, B 254, A 95, Java Hebbal, Purple Mauritius, D 625, D 1135, A 2, Q 116, B 6388, B 208, Q 813, J 247 in Gōdāvari, J 247, Red Mauritius in Chittoor, Fiji B, Red Mauritius, B 208, B 147, Ashy Mauritius, Local Reed, Local Striped, M 55, D 625, and 1135 in South Arcot, Red Mauritius in North Arcot, Co. 1, Java Hebbal, Poovan, Vellai and Chittan in Coimbatore District, and Red Mauritius, Java Hebbal, and B 208 in Malabar were affected.

TABLE I.

Statement of some cane varieties affected with localities and the extent of infection.

Variety.	Locality.	District.	Per cent of mosaic.	Remarks.
Red Mauritius.	Samalkota Government Farm.	Gōdāvari ..	67	
	Ryots' field, Pattambi.	Malabar ...	37·2	
	Nellikuppam	South Arcot.	75	
	* Taliparamba ...	Malabar ...	..	* Only a few clumps of a ratoon crop.
	Chittoor	Chittoor ..	50	
Purple Mauritius.	Samalkota Government Farm.	Gōdāvari ...	9	
B 254 ...	Do.	Do. ...	35	
A 95	Do.	Do. ...	23	
D 625 ...	Do.	Do. ...	9·8	
	Nellikuppam	South Arcot ...	50	
M 55 ...	Palur Experimental station.	Do. ...	6	
	Nellikuppam	Do. ...	60	
D 1135 ...	Palur Experimental station.	Do. ...	15	
Fiji B ...	Palur	Do. ...	5·8	
	Mudianur	Do. ...	60	

TABLE I—*cont.*

Statement of some cane varieties affected with localities and the extent of infection—cont.

Variety.	Locality.	District.	Per cent of mosaic.	Remarks.
	* Tondamanpatti ...	Trichinopoly.	...	* Two diseased clumps.
Co. 1 ...	Central Farm	Coimbatore ...	100	
	Tondamanpatti ...	Trichinopoly.	95	
Java Hebbal...	Do. ...	Do. ...	100	
	Samalkota Government Farm.	Gōdāvari ...	14	
	Pattambi	South Malabar.	...	
Poovan ...	Central Farm	Coimbatore ...	10	
Vellai ...	Do.	Do. ...	10	
J .47 ...	Samalkota Government Farm	Gōdāvari ...	1	
	Mamandur	South Arcot ...	60	
	Kallakurchi	Do. ...	2	
Local Nanal .	Mamandur	Do. ...	60	
	Kallakurchi	Do. ...	2	
B 208 ...	Samalkota Government Farm.	Gōdāvari ...	2	
	Kallakurchi	South Arcot ...	2	
	Tondamanpatti ...	Trichinopoly.	50	

Examination of canes for mosaic was done in the Imperial Cane Breeding Station, Coimbatore, during the three seasons, 1925, 1926, 1927. In 1925 a clump of M. 49201 showed suspicious symptoms of mosaic in the thin cane breeding station. These suspicions were confirmed in the crop of 1926 both at the Coimbatore Cane Breeding Station and at Pusa which had setts from this clump.

The following are the varieties which showed mosaic :—

THIN CANE STATION.

Varieties.	Number of stools affected during first survey.	Number affected, second survey.
M. 55032 (P.O.J. 2690 × Co. 205) ...	1	1
M. 55582 (Co. 221 × G.C.)	1	1
Co. 296 (Co. 213 × Co. 214)	1	1
Co. 205 (K. Boothan × P.O.J. 2696)...	1	1
M. 54244	1	1
Green sport	1	1
Kaluthai Boothan	Nil.	Whole row.
M. 35093	Nil.	2
M. 50921	Nil.	2
Co. 210	1	1
M. 57015	Nil.	3
M. 57018	Nil.	1
M. 57163	Nil.	1

The third survey of the station was conducted in 1927 but there was no case of disease.

Thick Cane Station, East Chitraichavadi.

Bontha	1
Vellai	2
Green sport	1
Cherribbonbrisbane	1
Pattapatti	2
Stripped cheribon	1
Batjan	2
B. 254	1
B. 3412	3
S.H. 22	2
H. 109	1
P.O.J. 100	2
P.O.J. 920	1
P.O.J. 2696	1
Maur. 33	1
Co. 17	1
P. 67	1
M. 54349	1

The effect of rogueing out in the thin cane areas in 1926 showed itself in the almost complete disappearance of the disease in 1927.

The detection of the disease in July 1927 at the East Chitraichavadi Thick Cane Station was at first surprising since the setts for this crop were carefully selected from healthy clumps. But later it was found to be a case of secondary infection, since a number of cane fields belonging to private owners in the neighbourhood were found to harbour the disease.

Symptoms and Effects.

From observations made in the cane breeding station and at the Central Farm, Coimbatore, two distinct types of mosaic could be differentiated on the leaves. In the first and commoner type, the normal healthy green colour forms the back ground for irregular whitish or pale white-yellow blotches. In the second type the normal dark green colour appears in a few irregular islands spread over a pale green back ground. Typical symptoms of the first are found in Red Mauritius, Co. 1, M. 55, and Poovan, while Java Hebbal and Vellai furnished the second type. The colour of the blotches vary from white to pale green. Observations showed that

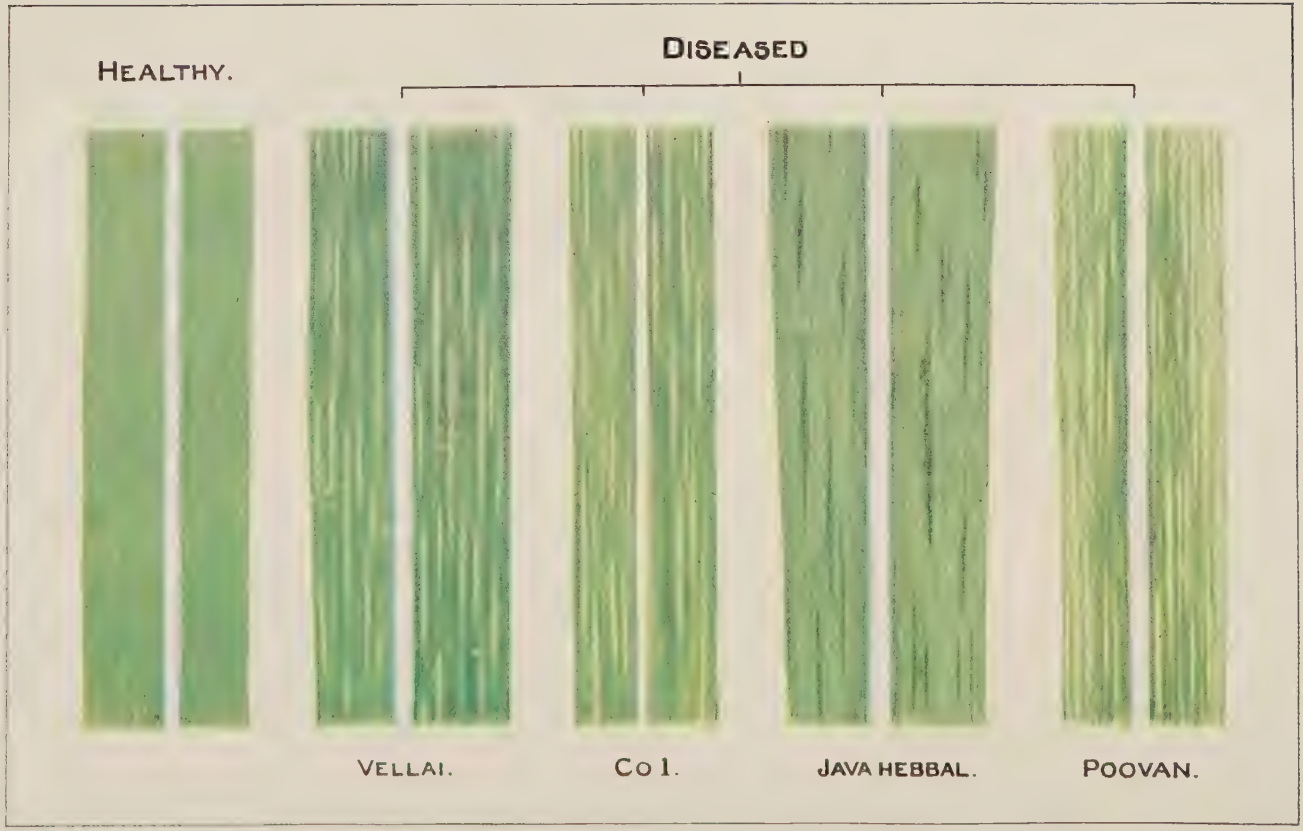

PLATE I

DISEASED. HEALTHY.

RED MAURITIUS.

PLATE II

the whiter the blotches the more easily detected is the disease in the growing crop. As a rule the colour of the blotches in the leaves deepens with age and they increase in size and some coalesce. (Plate I.)

Mosaic on the stalk.—Although the markings of the leaf are the earliest and the surest symptoms of mosaic, characteristic markings are often observed on the internodes of the stem. As in the case of the leaf the pattern of these markings varies with the varieties. In the dark rinded varieties, Red Mauritius, Fiji B, J. 247, M. 55, B. 147, etc., whitish or yellowish linear blotches are seen which by their colour contrast with the back ground and are more conspicuous than those found on the light coloured canes (*vide plate II*). In advanced cases of infection the marks on the stem develop narrow linear cankers resulting in the death of the rind tissue. Shrinking of the diameter of the cane and also stunting is noticed.

Histological.—The chloroplasts are smaller in size and fewer in number in the diseased than in the healthy leaves.

They are irregular and much enlarged in the diseased tissue.

The lighter coloured areas in an affected leaf are thinner than the green areas.

The cells in the light area of a diseased leaf are slightly smaller than those in the green areas. But it may be mentioned that the intracellular bodies were not seen in the samples collected from Coimbatore.

Methods of Infection and Spread.

A series of experiments were laid out at Coimbatore to determine the intensity of transmissability of mosaic and its spread under South Indian conditions. In all cases infection appeared and the disease was visible when setts from diseased clumps were planted or when they are inoculated.

Details of inoculation.—Freshly collected strips of mosaic infected cane leaves were rolled up and chopped with a sterile knife. The cut bits were immediately crushed in an agate mortar and the extract drawn in distilled water. The extract was inoculated by the following methods :—

(*a*) *Leaf inoculation.*—The extract was spread on young healthy cane leaf (either surface) and pin pricks were made through the droplets into the leaf with the aid of a sterilised platinum needle.

(*b*) *Sett inoculation.*—In one series, the extract from diseased leaf was injected with the aid of a sterile hypodermic syringe into healthy setts ready for planting. In a second series holes were bored with a cork borer at one of the cut ends of healthy setts and corresponding plugs from infected cane were inserted into the holes and the setts planted. In all the three series the majority of plants developed the disease as recorded in the table on page 10.

Inoculation Experiments.

Date of inoculation.	Number of plants or setts inoculated.	Number infected.	Date of infection.	Method of inoculation.
19th Jan. 1927 ...	8	3	17th Feb. 1927.	Pin prick on leaves.
Do. ...	6	...	...	Control.
Do. ...	8	4	17th Feb. 1927 and 26th Feb. 1927.	Injection.
Do. ...	4	...	...	Control.
12th Mar. 1927 ...	8	6	7th May 1927.	Tissue insertion.
Do. ...	4	4	...	Control.

Agencies in the spread of the disease.—From the observations recorded it is permissible to infer that the disease spreads not only from a diseased sett but also from a diseased to a healthy plant by means of insects. Such insects exist in India.

Alternate lines planted with diseased and healthy canes on the Central Farm, Coimbatore, showed (vide statement on page 11) that there is no escape from infection. Periodical examination in 1926 and 1927 of the experimental plots which were laid out primarily to study the varietal resistance and in which healthy setts were interlined with diseased seedlings raised from diseased setts showed an increase in the number of infected plants at each successive examination. Again in 1927 a selection of mosaic-free canes was made and the setts were planted both in the Central Farm and the East Chitraichavadi Thick Cane Station. Though the seedlings were originally free isolated cases of mosaic were detected subsequently. Inspection of the adjoining ryots' fields of sugarcane revealed the presence of mosaic infection. Observations above recorded in which secondary infection is proved suggest the existence of an insect agency in the spread of mosaic.

The survey of the insect fauna was therefore made and the following insects were found :—

Aphis maidis, A. Sacchari, Prella, Phenice moesta, Pseudococcus sp. and *Aleurodes* sp.

Preliminary trials were made to see whether *Aphis maidis* flourishes on cane. A number of insects were transferred from sorghum shoots with a camel hair brush to one month old Poovan seedlings enclosed in a wire gauze cage. It was found that the insects flourished on canes and gradually multiplied. Aphis proof cages measuring 8 × 3 × 3 (protected by brass wire gauze of 100 counts to the inch) were got ready and experiments were laid out with a view to study the *role* of this insect in the spread of mosaic.

The following is the scheme of experiments adopted :—

(1) A diseased and a healthy plant were enclosed in an insect proof cage without any insects.

(2) A diseased plant and a healthy plant were enclosed in an insect proof cage to which aphids from cholam were introduced.

(3) Two healthy plants were enclosed in a cage to which aphids from cholam were introduced.

These experiments have been in progress for several months and several repetitions were tried. The insects throve on canes, but so far no infection has been observed. Further experiments to prove this point are however in progress.

Varietal Resistance.

The heaviness of infection of particular varieties has already been noted. To test their relative resistance 24 varieties of healthy canes were planted in a portion of the Central Farm alongside of the diseased canes and periodical examination of the canes was made. The experiments were conducted in duplicates. The following tables indicate the relative resistance :—

Plot A.—*Interstripped with Red Mauritius.*

Varieties.	10th May 1021.	25th May 1927.	7th June 1927.	24th June 1927.	14th July 1927.	17th August 1927.	13th September 1927.	15th October 1927.	17th November 1927.	16th December 1927.	17 th January 1928.
B. 147 ...	0/25	2/25	3/25	3/25	4/25	3/22	3/22	4/20	6/17	6/15	3/14
B. 208 ...	1/28	3/28	4/28	10/28	10/28	6/24	4/24	4/21	4/19	4/18	4/18
B. 3,412 ...	0/24	3/24	5 24	5/24	6/24	4/24	3/21	3/21	3/20	3/20	4/20
B. 6,308 ..	0/29	3/29	4/29	8/29	11/29	8/27	9/27	9/27	10/27	10/27	12/26
B. 6,450 ...	0/26	12/26	16 26	16/26	25/26	16/24	13/20	13/18	12/14	11/13	11/12
D. 131 ...	5/29	15/29	20 29	20/29	24/29	24/29	25/29	25/29	24/28	24/28	24/27
D. 625 ...	2 29	19/29	23/29	24 29	24 29	21/26	18/24	17/23	17/21	16/21	18/19
D. 1,135 ...	0/29	11/29	16/29	16/29	25/29	25/29	25/28	24/28	23/28	23/28	26/27
Fiji B. ...	0/23	2/23	3/23	9 23	10 23	15/23	10/21	12/18	13/17	13/16	13/16
Fiji C. ...	0/30	4/30	5/30	11/30	11/30	11/26	7/23	8/23	9/22	10/22	11/19
J. Hebbal ...	1/25	11/25	16 25	17/25	16/25	18/25	16/23	17/21	18/20	18/20	14/16
J. 247 ...	1/24	10/24	14/24	13/24	16/24	14/24	11/31	13/20	14/19	14/19	8/13
M. 55 ...	2 29	15/29	17/29	18/29	22/29	24/29	24/29	25/29	25/29	26/29	26/28
R. Mauritius.	1/30	16/30	22/30	25/30	24 30	25/30	26/29	26/28	25/27	25/26	25/25
P. Mauritius.	2/25	8/25	11/25	10/25	11/25	14/25	13/25	15/25	16/25	17/25	13/23
Q. 116 ...	0/28	17 28	23/28	23 28	23/28	25/28	23/38	23/28	23/27	23/27	24/25
Q. 813 ...	0/28	5/28	6/28	7/28	8/28	10/28	11/26	11/28	10/24	10/24	8/18
Butjan	3/27	17/27	19/27	19/27	16/27	16/24	17/21	17/19	16/18	16/17	15/16
Tana ...	0/26	3/26	4/26	7/26	12/26	14/26	16/24	10/17	8/13	3/5	4/4
Chittoor Poovan.	5/27	16/27	19/27	23/27	22/26	20/27	21/26	21/26	21/25	21/25	16/21
P.O.J. 2 714.	0/19	0/19	0/19	0/19	0/19	0/18	0/18	0/18	0/18	0/18	0/18
P.O.J. 2,717.	0/30	6/30	8/30	8/30	12/30	13/30	15/30	9/30	9/30	9/30	10/30
Vellai ...	4/27	14/27	20/27	20/27	20/27	21/27	19/26	18/25	17/24	16/24	22/23
Poovan ...	2/29	9/29	13/29	18/29	19/29	21/29	21/29	20/29	22/28	22/28	21/27

Notes.—(1) Date of planting. 3rd March 1927 and 4th March 1927.
(2) Number of setts planted in each row. 30.
(3) Secondary infection visible about 3 months after planting.
(4) Infection spreads rapidly during the next three months after which there is a marked fall. This is due to the plants either turning pale or drying.
(5) The numerator denotes the number of clumps infected and the denominator the total number of clumps in each row.

PLOT B.—*Interstripped with Java Hebbal.*

Varieties.	11th May 1927.	26th May 1927.	10th June 1927.	25th June 1927.	14th July 1927.	18th August 1927.	15th September 1927	17th October 1927.	18th November 1927.	17th December 1927.	19th January 1928.
B. 147 ..	1/28	10/28	15/28	16/28	16/28	18/28	16/26	16/24	17/22	17/22	11/21
B. 208 ...	3/30	16/30	22/30	22/30	23/30	21/27	22/26	19/21	15/18	12/16	10/16
B. 3,412	1/26	9/26	16/26	18/26	19/26	16/26	16/24	16/24	16/23	16/23	13/23
B. 6,308 ...	0/29	2/29	4/29	10/29	13/29	15/29	15/29	15/29	15/28	14/28	15/28
B. 6,450 ...	0/23	9/23	15/23	15/23	14/23	16/23	10/22	10/20	10/19	10/18	3/15
D. 131 ...	1/30	18/30	26/30	26/30	25/30	25/30	27/30	26/30	25/30	25/30	26/30
D. 625 ...	2/30	16/30	27/30	27/30	26/30	24/30	23/30	23/30	24/30	24/29	23/28
D. 1,135 ...	0/30	8/30	18/30	23/30	24/30	20/30	21/30	21/20	21/30	21/30	23/28
Fiji B. ...	1/29	5/29	7/29	7/29	10/29	11/29	9/29	8/28	7/27	7/26	11/26
Fiji C. ...	0/30	3/30	6/30	6/30	6/30	9/30	7/27	7/26	6/25	6/25	6/22
J. Hebbal .	1/30	10/30	17/30	19/30	20/30	19/28	20/28	20/27	19/27	19/27	18/27
J. 247 ...	0/30	6/30	15/30	16/30	16/30	6/28	12 27	10/23	10/22	9/22	5/20
M. 55 ...	1/30	19/30	24/30	24/30	26/30	25/30	26/29	26/29	26/29	26/29	26/29
R. Mauritius.	4/30	17/30	24/30	27/30	27/30	27/30	29/30	29/30	29/30	29/30	30/30
P. Mauritius.	0/30	13/30	22/30	26/30	24/30	24/30	22/28	21/28	21/28	21/27	21/26
Q. 116 ...	2/30	15/30	24/30	25/30	29/30	25/30	22/27	23/25	24/24	24/24	23/24
Q 813 ...	0/30	1/30	2/30	7/30	10/30	6/30	7/29	5/28	3/28	3/28	2/25
Butjan ...	0/29	7/29	10/29	13/29	10/29	10/24	10/20	11/19	11/19	11/19	10/17
Tana ...	0/22	1/22	2/22	2/22	2/22	0/22	0/20	0/19	0/19	0/19	0/19
Chittoor Poovan.	0/27	4/27	6/27	8/27	9/27	9/27	9/26	8/25!	6/23	6/23	8/23
P.O.J. 2,714.	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25	0/25
P.O.J. 2,727.	0/29	1/29	2/29	5/29	5/29	8/29	6/29	5/29	5/29	5/29	4/29
Vellai ...	0/25	6/25	10/25	18/25	18/25	12/23	9/23	10/20	14/19	14/19	15/19
Poovan ...	0/30	6/30	11/30	13/30	18/30	15/26	15/23	15/28	15/22	15/22	15/21

NOTE.—(1) Date of planting, 3rd March 1927 and 4th March 1927.

(2) Number of setts planted in each row, 30.

(3) Secondary infection visible about 3 months after planting.

(4) Infection spreads rapidly during the next 3 months after which there is a marked fall. This is due to the plants either turning pale or drying.

(5) The numerator denotes the number of clumps infected and the denominator the total number of clumps in each row.

It is clear that Mauritius, Barbados, Java Hebbal, and the locals are susceptible to a very high degree, while P.O.Js. and Fijis show low percentage.

Of the above P.O.J. 2714 seems more immune than others having remained free during the two years trials it had.

Itis seen from Table No. II that secondary infections are visible when the crop is 3 months old and infection spreads rapidly during the next 3 months after which there is a marked fall. This is due to some of the plants either turning pale or dying.

Control Measures.

The two methods of infection are primary and secondary. The former is more important and potentially more dangerous as the disease spreads through indiscriminate distribution of the infected setts. The work of insect agency is, however, confined to plants in the immediate neighbourhood. The chief measure of control has been planting disease-free setts. These should be obtained from fields free from disease and if possible from tracts free from disease. If the disease-free setts are planted the chances of damage of insect agencies also become reduced.

Seedlings raised from infected setts will show symptoms of mosaic from the second month onwards when they can be detected and rogued out. Secondary infection takes place between the third and the sixth month of the crop. All crops of cane should therefore be systematically examined, say once in a month, from the second month to the sixth and any clumps showing mosaic should be pulled out. If, however, a field happens to be planted with infected setts and the percentage of infection is high, rogueing will be impracticable and costly. Such a crop may be allowed to mature but should be milled, taking care that setts from this field are on no account used for seed. The recommendations detailed above have been practised in several fields in Coimbatore with striking results. Crops of Co. 1, Poovan, Vellai, and Java Hebbal which were detected late in the season as severely affected were allowed to remain and milled completely. Selected setts were planted in the adjacent plots. During the next season stray cases of mosaic were observed. These were rogued out and subsequent crops in this field have remained free.

Stray cases of mosaic existed at the Chettipalaiyam cane breeding station during the first two years of the survey. The extent of disease was so small that rogueing was rendered an easy task. Added to this the rigorous sett selection resorted to during subsequent plantings made it possible to keep the station so far free.

To stamp out the disease from the cane-growing tracts of the Presidency, it is necessary that the cane growers should have a full knowledge of the symptoms and effects produced and a clear idea of the methods of checking it. Instructions under this head have already formed the subject of leaflet No. 42 published in all Vernaculars which should be consulted.

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